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ABSTRACT

Two topics that are important for improving the teaching of science in the elementary grades are: (1) the availability of classroom science materials and equpment; and (2) teacher improvement in subject matter competencies, instructional skills, and familiarity with technology. A workshop was developed to help teachers develop instructional strategies for teaching children science using basic science materials and available resources. Emphasis was on process-oriented activities, group work, discrepant events, learning cycle activities, questioning strategies, Project Wild and/or Project Learning Tree materials, integrating textbooks with curriculum projects, outdoor classrooms, field trips, and community resources. The paper documents the goals of the workshop, planning materials, personnel recruitment, curriculum, results of follow-ups, evaluation, and offers concluding remarks. (KR)

ENHANCING PRIMARY GRADE SCIENCE:

RECOMMENDATIONS FROM PRIME TIME WORKSHOPS

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Enhancing Primary Grade Science:

Recommendations from Prime Time Workshops

Authors of the recent national report, Educating Americans for the 21st Century (The National Science Board, 1983), have targeted science as one of the new "basics" and cited its critical role in America's future economic success. Likewise, concern for early childhood learning has received renewed interest from non-educators as well as educators who are eager to build programs that will provide solid foundations for academic achievement. In response to the latter, the legislature and general public of Indiana have for the past several years supported the Governor's Prime Time Program which has focused on funding for smaller classes or teacher assistants in the early grades.

The 1986 Indiana Needs Analysis Project (Kloosterman & Harty) revealed that two areas were important to the improvement of teaching science in the elementary grades: (1) availability of classroom science materials and equipment and (2) teacher improvement in subject matter competencies, instructional skills, and familiarity with technology. Following science textbook adoption which occurs every seven years in the state, the Indiana Department of Education funded summer institutes in 1987 to enhance the instruction of science in Prime Time classrooms. Universities were invited to submit proposals for workshops throughout the state which would include teacher participants from grades K-3. The authors of this report were involved with initial grant writing, curriculum development, and instruction at three of the sites where the awarded projects were administered.

Goals

Smaller class sizes or aides enable teachers to work with individuals and groups more frequently in any subject area. In order to improve science instruction in these early grades, several goals were addressed:

1. conceptual understanding of science as a process rather than a set of facts to memorize.
2. experiences with hands-on activities and familiarity with basic science equipment.
3. discussion of the integration of science with other subjects.
4. creation of science learning centers.
5. establishing collegial support and a foundation for development of expertise.
6. development of positive attitudes toward science teaching and learning.

Planning

The workshops were administered through the Office of School Programs at Indiana University, Bloomington through which initial proposal writing and curriculum development occurred. The primary concern was to help teachers develop instructional strategies for teaching children science using basic science materials and available resources. In recognition of this goal, the curriculum planners identified process-oriented activities which the teachers could use with primary grades students. At each site, teacher participants received a packet of science materials (bar magnet, magnifying lens, magnifying box, etc.) along with supporting books (two Naturescopes), and several science education resources books were displayed for browsing. The structure of the sessions remained under control of individual site instructors. For example, some instructors selected full-day sessions, while others chose half-days to meet the 15 contact hours required. A notebook containing an overview of the workshop, syllabus, intended outcomes (see Appendix), selected articles, background activities, guidelines, and resources was given to each teacher.

Personnel

The instructional personnel at each site included the lead professor, two practicing classroom teachers, and a scientist or graduate student. The collaboration of staff made group work feasible and provided an array of insight and suggestions on each topic. Individual sessions were also conducted with various instructional leaders. Flexibility in scheduling allowed adjustments such that concerns surfacing early in the week could be addressed in later meetings.

Notices sent through the state and local media were designed to attract 40 inservice K-3 teachers at five locations. The participating teachers represented all types of school districts surrounding the workshop sites of Bloomington, Indianapolis, Kokomo, Richmond, and Crawford County. Many participants were highly experienced teachers with master's degrees completed several years previous to the workshop. Most had not attended any special science education class in recent history, and several had never completed a science methods course in undergraduate school. There was a fairly equal balance among teachers in grades K-3; this was not designed by the selection process which was basically controlled by date of application.

Curriculum

The importance of teaching science and the ease with which it can be taught in the early elementary grades became the underlying theme of the sessions. Emphasis throughout the workshop was also placed on encouraging teachers to use children's natural curiosity and affinity for science. This interest is not always adequately measured by traditional paper and pencil worksheets or exams, and teachers were continually reminded that science is a process, not a set of facts to memorize. Children should also be allowed to use their knowledge in a systematic way to solve problems and to make decisions in their world. Thus, teachers need to develop attitudes and evaluation practices to reflect this philosophy.

The curriculum stressed the importance of group work in Prime Time classrooms. This strategy allows teachers to have more opportunities to observe and challenge students directly. In fact, the same instructional activities advocated for elementary students became essential parts of the teaching strategies during the workshops. These activities were designed to build self-confidence, alleviate science anxiety, promote hands-on experiences, practice patience, and address state science proficiencies (see Appendix).

Specific topics included: process skills activities, discrepant events, learning cycle, questioning strategies, Project Wild and/or Project Learning Tree, integrating textbooks with curriculum projects, outdoor classrooms, field trips, and community resources. Large group and small group sessions were employed for these discussions and activities.

During the final hours of the workshops, participants displayed and described a learning center developed for their students next year. In many instances, materials given to the teachers were used in these learning centers; in other cases, the teachers created learning centers reflecting special interests or expertise.

In addition to attendance and participation throughout the summer sessions, teachers were required to conduct follow-up workshops in their home districts during the autumn. Activities and topics for the one- to two-hour peer inservice time were determined by the local presenters. Although there was some anxiety and reluctance to complete this task, the instructor offered concrete suggestions along with philosophical encouragement. Many teachers chose to demonstrate Project Wild or Project Learning Tree activities which participants had successfully used in classrooms.

The teacher/peer workshops in the schools appeared to be successful; the teachers were creative and shared enthusiasm when reporting to their peers. In some instances, workshop slides/photos taken and shown during the summer were borrowed for use in individual schools. The teachers became disseminators of information and local resource persons for good science instruction in the primary grades. This experience brought positive feedback to participants and renewed interest in the summer workshop themes.

Later in the autumn, a seminar for all participants was held to share comments about implementation of ideas into the classroom and about the success of peer inservice sessions. The majority of the teachers had completed workshops in their own districts; however, several had not. The enthusiasm and success of the teachers completing this assignment became resourceful incentives for the stragglers. Through this final requirement closure was reached, and it is believed that the summer workshops had far-reaching impact.

In these final seminars, individuals or groups representing highly successful home school workshops were asked to volunteer for further dissemination of workshop strategies at the spring state science teachers meeting. Registration fees were paid for these participants, and all summer participants were encouraged to attend the meeting in Indianapolis.

Summary of Features

Verbal and written evaluations received during and at the completion of the workshop have convinced the authors that several unique features contributed to the success of these institutes and can be useful guidelines for science educators designing programs in the future.

1. Specific needs of teachers in the primary grades include discussion of science processes along with reassurance that they can facilitate good science education in every classroom.
2. Basic equipment is lacking throughout our schools; giving a few supplies to each teacher and demonstrating the use of household materials were critical.
3. Identifying formal and informal resource people and materials (instructors, textbooks, reference lists, colleagues community resources, etc.) was beneficial.
4. Providing adequate discussion time during the sessions enabled teachers to express questions and realize common concerns along with building networks.
5. Requiring a small project at the completion of the summer workshop enabled each participant to leave with ready-to-use support materials.
6. Requiring follow-up workshops in local schools brought closure and practical applications to the knowledge and beliefs which were integral parts of the summer sessions.

Conclusion

The attitudes and concerns of summer Prime Time participants are similar to most elementary teachers in America: they care personally and professionally about the education of children; they feel inadequately prepared to teach science; equipment and supplies are rarely available; class time and concern are devoted almost exclusively to reading and mathematics instruction; and they lack knowledge on innovative teaching strategies and resources to improve science instruction. Funding for the Prime Time Program in Indiana continues to provide opportunities for smaller classes and teacher aides despite recent debate on the value of reducing the teacher/student ratio. The focus on science textbook adoption year and subsequent summer workshops enabled science educators to address the needs of many classroom teachers and advocate changes for effective science instruction in the early grades. The experiences of the instructional team and the participants yield strong beliefs that the intensive workshop promoting understanding and practicing good science instruction can have effective results in individual classrooms. The peer inservice workshops demonstrated that knowledge shared with teaching colleagues can have a positive impact on disseminating information and sharing ideas. Hopefully, this mixture of theory and practice, along with a commitment to promote good science education among colleagues, will continue to be beneficial to Indiana's Prime Time teachers.

Kloosterman, P., & Harty, H. (1986). Indiana needs analysis project. Bloomington, IN: Indiana University, School of Education.

The National Science Board Commission on Precollege Education in Mathematics, Science and Technology (1983). Educating Americans for the 21st century. Washington, DC: National Science Foundation.

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IMPORTANCE OF TEACHING
PRIMARY SCIENCE

We propose that all primary schools establish as a matter of priority a science education policy across the curriculum based on the following essential characteristics:

(1) That what is undertaken under the teaching of science should arise out of the spontaneous interests of the children and should not be imposed upon them with the aim of laying foundations, in a formal sense, for future science studies.

(2) That elementary scientific ideas should be derived from the exploration of the immediate environment and should involve the application of an attitude of inquiry and the establishment of personal patterns of understanding from first-hand experience.

(3) That pupils should be encouraged through the careful management of their learning environment to make emergent generalizations of a temporary nature, and be given the confidence to accept that these will have to be modified in the light of further experience.

(4) That pupils, through individual and small group work, should be encouraged to speculate freely on the nature of objects and phenomena. In particular, strong emphasis should be placed on the pupils' talking about, and discussing, science and on encouraging the creative expression of personal meaning in their own language and through modes other than formal writing.

(5) That all scientific work should arise within the context of an integrated curriculum. Science should not be separately timetabled, or be taught in a specialist room. Existing course materials should be available in all classrooms as part of accessible resources.

(6) Finally, scientific phenomena should be freely used as the starting point for a wide range of creative work, e.g., poetry, story writing, drama, painting, model making, as part of the process of establishing a confident and open approach to science studies.

From: Alternatives for Science Education. Published by The Association for Science Education, Garden City Press, Letchworth, Hertfordshire, 1979.

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PROFICIENCY AND INDICATOR LIST 061000

SPECIFIC PROFICIENCY STATEMENTS
AND
PROFICIENCY INDICATORS
KINDERGARTEN/PRIMARY SCIENCE

Through science learning opportunities provided in the kindergarten and primary grades, student should develop the ability to:

1. use the five senses to gather and collect data.

Sample Indicators:

a. discriminate among sets on the basis of observable properties such as texture, size, shape, color, weight, or smell.
b. identify sounds on the basis of loudness, pitch or duration.
c. escribe objects in terms of hotter or colder.
d. iscriminate among substances that are solids, liquids, or gases.
e. describe foods on the basis of taste.

2. sort, group, or arrange objects, systems, ideas, or events on the basis of similarities, differences, or a suggested standard.

Sample Indicators:

a. sort plants from animals based upon given standards.
b. sort living from non-living based upon given standards.
c. classify objects or events in the natural world based upon a selected similarity or difference.
d. select objects that may have further use from a group of objects that have served the purpose for which they were designed.

3. use simple instruments to describe observations more accurately.

Sample Indicators:

a. quantify size in three dimensions.
b. measure objects in order to compare their size, weight, temperature, direction, or location.
c. use different types of lenses to observe objects.
d. describe different sounds after listening to them with a stethoscope.

END

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